MANGROVE FLORA AND THEIR PHENOLOGY OF KRISHNA ESTUARINE REGION, ANDHRA PRADESH

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ABSTRACT

The mangrove plants are most important features of the estuarine area of the country. The existence of the mangroves has been increased the production and unique nature of its flora and fauna. The mangroves has been under intensive pressure of exploitation for the last three decades which in addition to direct cleaning, cutting and conversion have placed the mangrove under threats. Fish and Shrimp farming is the most destructive form of resources using the mangrove has been converted, which is leading to ecological damage. Conversion have been raised among the Ecologists, Biologists and other policy makers since 1989; deliberately destruction of mangrove plants and unplanned development of Coastal Aquaculture particularly Shrimp/Fish culture have been put under extreme criticism and sustainability has been question mark. The present study was undertaken to observe the floral distribution and their flowering and fruiting season of Krishna mangroves. There are 23 species of mangrove plants and their phenology are recorded around the study area. These 23 mangrove species consists of 13 families and 18 genera. It is suggested that the management options and the policy aspects should be amended accordingly, stake holders at all levels of resources exploitation must take part contribute to conservation and management.

KEYWORDS: Mangroves, Flowering and Fruiting, Season, Krishna Estuary

INTRODUCTION

Mangroves forests are established at the inter tidal zones of estuaries, back waters, deltas, creeks, lagoons, marshes, swamps and mud flats of tropical and subtropical latitudes. The mangrove ecosystems have specialized adaptations in the inter-tidal zone (Tomlinson, P.B., 1986). According to Forest Survey of India the total 4,87,100 ha mangrove wetlands are recorded in India. In that 56.7% (2,75,800 ha) are present in the east coast and 23.5% (1,14,700 ha) in the west coast, the remaining 19.8% (96,600 ha) is located in the Andaman Nicobar Islands (FSI, 1999). The East Coast mangroves are known to be highly divers in compare with those of the West Coast (Selvam et al., 2000). Andhra Pradesh has 58,250 ha are under mangrove cover, representing 0.9% of the state total forest covered area (Ravishankar et al, 2004). Mangrove forests are habitat of variety of species for feeding, breeding grounds and also support the coastal fisheries (Manson et al., 2005). In Worldwide about 30% of all commercial fish species are directly dependent on mangrove forests (Naylor et al., 2000) stated that an annual catchment of several million tons and it may influence water quality (FAO, 2004). The extensive reviews on mangrove habit for terrestrial and marine fauna explained in detail (Hograth, 1999; Quasim and Kathiresen, 2005). Nagelkerken et al., (2008) summarized that the mangrove as a habitat for terrestrial and brackish fauna with special reference to the inter-tidal zone with adjacent habitats and the important of litter in mangrove food web. Mangrove forests are the group of plants taxonomically isolated and successfully adapted with flowering and fruiting in colonizing inter-tidal zones at the interphase between the land and coast along the deltas, back waters and other estuarine regions. Krishna mangroves located with the boundaries of 16° 02′ N Latitude and 80° 93′ E Longitude. It is encircled by different villages of Krishna estuary.

Mangroves of south and Southeast Asia are most extensive and diverse mangrove systems comprising 41.4% of Global mangroves (Kathiresan, 2003). Mangrove ecology and their management have been described by following authors in different ways (Hamilton and Snedaker, 1984; FAO, 1994; UNU 2004). Worldwide about 30% all commercial fish species are directly or indirectly dependent on mangroves (Naylor et al., 2000). They form the soft sediment of the environment (Ellison and Farnsworth, 1992). As such mangrove forests become, different groups of animals found in the different mangrove habitat in the various groups of micro and macro fauna includes prawns, insects fishes (both bony and elasmobranches), amphibians, reptiles and birds of fauna.

Mangroves plants have immense ecological and economic importance. Approximately one third of the World mangrove forests has been lost due to various coast development activities over the past 50 years (Alongi, 2002). They not only provide socio-economic benefits to local tribes, but also provide protection to coastal areas against natural disasters and facilitate the formation of land by trapping sediments (Kathiresen, 2003). The works of Kathiresan (1992) is based on the earlier survey and available literature and mangrove flora, it is an authentic work as far as the mangrove plant species in Tamil Nadu and West Bengal. In Andhra Pradesh coast most of their work is restricted to the Godavari estuarine region and very limited work done in the Krishna estuary. The mangrove ecosystem is undergoing widespread degradation due to a combination of physical, biological, anthropogenic and social factors. A variety of human induced stress and factors such as

change in water quality, soil salinity and sedimentation due to diversion of freshwater in the upstream are causing degradation of mangroves. Mangrove plant communities with their high level species diversity display Phenological events staggered in time and space, which are governed both by biotic and abiotic factors. Understanding of Phenology behavior of the plants is useful in evolving proper management strategy. Information on phenology is useful in predicting the interactions of plants and animal to the changing in different estuarine ecosystem. The present study emphasizes the status of mangrove fauna and their flowering and fruiting in the Krishna Estuary.

MATERIALS AND METHODS

The present study has been carried out in the Krishna estuary, a Periodic field visit Machilipatnam, Sorlagondi, Lankevanidibba, Hamsaladeevi, Adavuladeevi, Kothapalem, Dindi and Nizampatnam area have been made to record of the present status of the mangrove plants in the above ecosystem. In the above Reserve forests selected pockets, density of different species of mangrove plants has been recorded.

Fig.1: Map Showing Krishna Estuary

Sl. No.	Plant Name	Family	Local Name	Flowering	Fruiting
01.	Dalbergia spinosa	Fabaceae	Chillingi	August-September	--
02.	Derris trifoliata	Fabaceae	Nallategi or Tippa-teegi	June-October	October
03.	Rhizophora apiculata	Rhizopho-raceae	Uppupon-na	July-February	June-March
04.	Bruguiera cylindrica	Rhizopho-raceae	Vurada	March-June	April-August
05.	Bruguiera gymnorrhiza	Rhizopho-raceae	Tuddu-ponna	July -September	August-February
06.	Ceriops decandra	Rhizopho-raceae	Gatharu	Total year	Total year
07.	Lumnitzera racemosa	Combreta-ceae	Kadavi	July-January	August-February
08.	Sonneratia apetala	Lythraceae	Kalingi	--	--
09.	Sesuvium por-tulacastrum	Aizoaceae	--	November-December	--
10.	Aegiceras corniculatum	Primula-ceae	Guggil-liam	July-September	August-October
11.	Heliotropium curassavicum	Boragina-ceae	--	June-August	February-August
12.	Acanthus ilicifolius	Acantha-ceae	Alchi	July-October	August-November
13.	Avicennia alba	Acantha-ceae	Tellamada	June-September	September-October
14.	Avicennia marina	Acantha-ceae	Arramada	June-September	September-October
15.	Avicennia officinalis	Acantha-ceae	Nallamada	June-September	September-October
16.	Clerodendrum inerme	Lamiaceae	Pisunga	March-June	June-July
17.	Salicornia brachiata	Amaran-thaceae	Picchi-kalakura Aku	May-August	June-October
18.	Suaeda maritime	Amaran-thaceae	Manchi-kalakura Aku	April-October	May-October
19.	Suaeda monoica	Amaran-thaceae	--	April-August	May-September
20.	Suaeda nudi-flora	Amaran-thaceae	--	Total Year	Total Year
21.	Excoecaria agallocha	Euphorbia-ceae	Tillaku	May-August	August
22.	Fimbristylis ferruginea	Cypera-ceae	--	July-August	--
23.	Aeluropus lagopoides	Poaceae	--	December-April	--

Table-1: List of Mangrove plants in the Krishna Estuary, Mangrove Region.

RESULTS AND DISCUSSION

Richness in Biological Diversity of Species and Estuarine system functions in the coastal zones initiate for the production of resources and services essential to the human beings. Conservation of plant diversity is therefore and vital components in managing commercially rich valuable animal and plant resources of these coastal zones. Biodiversity is basis for human existence and encompasses all life forms in the ecosystem. In the present study 23 species of mangrove plants belong to 13 families were identified and their flowering and fruiting seasons also recorded around the study area. The predominant flowering and fruiting months for recorded mangrove species in Krishna Estuary are given in Table No.1. The flowering season of majority of species are Rainy season. *Ceriops decandra* and *Suaeda nudiflora* are flowering throughout the year and flowers are continuously for a prolonged period and an individual plants were observed in different stages of flowering and fruiting, e.g. flower bud initiation, flowering, fruit initiation, intermediate and mature fruits. River Krishna joins Bay of Bengal chiefly through three distributaries. Hamsaladevi distributary branches off from the main river 60 km downstream from Prakasm barrage and opens into bay of Bengal North of Machilipatnam after a distance of where the distributary branches off from the main river, Gollamattapaya and Nadimeru distributaries branches out from the main river. The main river joins the bay at the Devi point (Rama Krishna, 2000). The river Krishna mangroves area has been declared as a wild life sanctuary in 1998 by the Govt.

of India, the total area of sanctuary is about 19.481 ha. The total area of drainage basin the river Krishna is about 2.6×10^5 km^2 and mean value discharge is 6.0×10^{13} (Varadarajulu *et al.,* 1985). In peninsular India, mangrove ecosystem of the river Krishna and Godavari are the largest wetland areas covering an extent of 58,520 ha of which Godavari mangrove systems represent 3220 and that of Krishna 2,000 ha (Sarin *et al.,* 1985).

Mangrove ecosystem of Krishna estuary and their management has been studied by Lakshminarayana (1992). Benerjee (1997) reported 29 species of mangrove plants in the estuary region of river Godavari and Krishna. Salinity is one of the most important factors in mangroves in establishment and early development (Ball, 2002). Most of the mangroves are facultative halophytes (i.e. they grow better in or some salt but do not necessarily require for growth) and studies have demonstrated the optimal growth rates occur in 5-7.5% marine water concentrations (Burchett et al., 1984, 1989; Ball, 1988). Smith and Snedakar (1995) stated that salinity variations influence species and seedling growth stages. Although most mangroves propagules can tolerate a wide range of salinities, the persistence and exposure to physical and physiological desiccation increase with temperature and increase salinity.

Decline of the diversity of the mangrove plants in this region due to different factors such as exploitation of the commercially important plants by the coastal population released of shrimp pond effluents and chemical contamination. Further, dyes factory in the near Pedana, other fishing activities has been decline in the mangrove plants *Avicenia officinalis* in this area. Studies carried out by Vaiphasa *et al.,* (2007) in Pak Phanage, Thailand on the effect on the deposition solid waste from shrimp ponds. Ranga rao *et al.,* (2003) stated that populations and the effluents released from the aqua farms into mangrove area, the pollutants to accumulate southern part of mangroves of Godavari mangrove forest area. Ravi Shankar *et al.,* (2004) reported that the 14% of the aquaculture farming in Godavari estuarine region are developed in mangrove-wet lands. Arisdason *et al.,* (2008) concluded that the mangrove plant diversity has been effected in the river Krishna and Godavari estuary region are due to the biological pressure and other anthropogenic activities. The optimal range of physiological function and growth of seedling is approximately from 3- 27ppt (Field, 1984; Hutchings and Saenger, 1987; Ball and Pidsley, 1995; Aziz and Khan, 2001). Krishna *et al.,* (2017) recorded physicochemical parameters and salinity influence of Krishna estuary.

Chakravartty *et al.,* (2017) reported that over exploitation of aquaculture in mangrove areas, have resulted in loss of local habitat and the restricted shrimp exports. This is a critical environmental imbalance as the mangroves are the lungs of our planet. Ecological technologies with integrated aquaculture can be an indication welcome change in the mangrove belt and with the demand for a steady food guarantee being continuously on high tide, we should rise together to build a sustainable future for our wetlands. Krishna and Mudhusudhanarao (2011) clearly explained need for conservation and management of mangroves in Krishna estuary region.

Salcedo *et al.,* (2024) reported that the mangrove vegetation development and status was assessed with remote sensing for the period 1929–2022 using images of the Agua Amarga Salt Marsh and the Coastal Aquifer connected to it have been subject to anthropogenic intervention since 1925 are recorded and near-infrared spectral resolution. Field data are employed to evaluate the protocols and compare the results, showing around 46% are decreased caused by the salt works and a 50% increase as a result of natural evolution and artificial recharge. The spread of *Phragmites australis* is also addressed by comparing data with field monitoring, showing an increase of 12% during the period 2005–2023. The advantages and complementarity of field monitoring and a potential source of information that could help control the spread of invasive species in a scenario where water management measures are implemented.

In spite of their immense role in protecting human resources as well as biodiversity, these mangroves are unique. Krishna mangrove habitats of East coast, India have been facing tremendous threats due to indiscriminate exploitation of mangrove resources for multiple uses like timber, fuel wood, fodder, for building material, paper, alcohol and so many hectares are converted into shrimp and fish farm. Apart from construction of Nizampatnam harbour and extensive activities of human inhabitation and other industrial activities are causes of depletion of mangroves. Studies of morpho-anatomical characters in relation to adaptation to halophytic condition flowering and fruiting can help the formulating strategy plan to mangroves. The classification system based on the characters may also be a guidelines to select the appropriate mangrove zone for respective flora.

CONCLUSION

The findings of the present study may useful in restoration initiatives requiring collection of healthy planting materials. The seed predation is an important determinant of the structure and composition of mangrove forests as propagules are food for so many animals. In order to maintain a healthier coastal ecosystem, it is necessary to conserve mangroves and other vegetation. This is because they are functionally linked and hence damage to one ecosystem may cause harm to others. In this regard, it is emphasized all the coastal ecosystems simultaneously. Restoration of mangroves in simple, cost effective and practical way of improving the bio-resources of the ecosystems, while the bio-resources of the coastal systems, while the restoration of the coastal zones.

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